

## Superbug Hideout

### Finding MRSA in U.S. Wastewater Treatment Plants

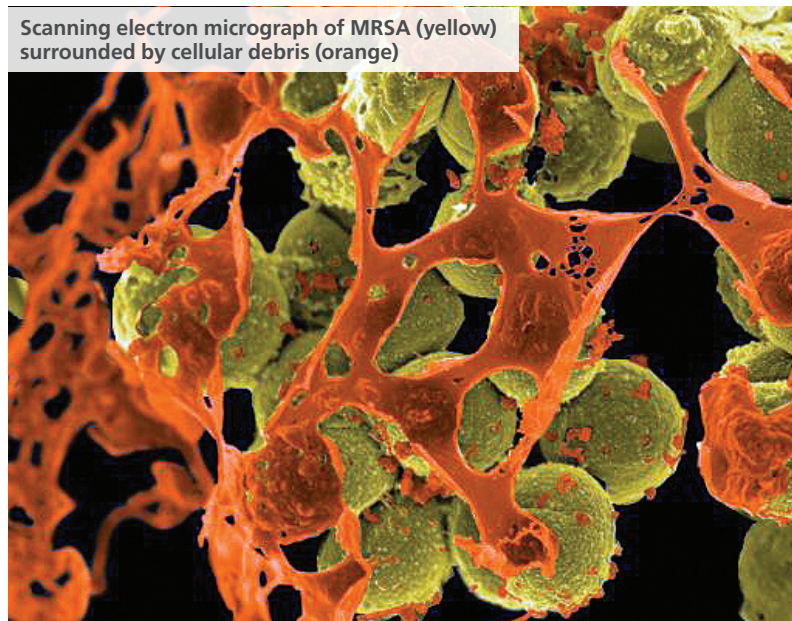
For many years, the “superbug” methicillin-resistant *Staphylococcus aureus* (MRSA) was confined to hospital patients, but since the 1990s it has been infecting otherwise healthy people in settings such as schools and locker rooms. Researchers now report the discovery of MRSA in U.S. wastewater treatment plants (WWTPs), identifying another possible environmental reservoir for the bacteria [EHP 120(11):1551–1558; Rosenberg Goldstein et al.]. People shed MRSA from their nostrils and skin and in their feces, which makes wastewater a likely vector for the bacteria. Previous research had identified MRSA in Swedish WWTPs, but no studies had been conducted on U.S. facilities.

The researchers collected wastewater samples throughout the treatment process at two mid-Atlantic and two Midwestern WWTPs. MRSA, as well as pathogenic methicillin-susceptible *Staphylococcus aureus* (MSSA), were present at all four WWTPs, with MRSA detected in 50% of all samples and MSSA detected in 55%. Genetic testing of the MRSA isolates revealed traits common among exceptionally virulent community-acquired strains circulating in the United States. Most MRSA isolates and 29% of MSSA isolates showed resistance to two or more classes of antibiotics, including several that the U.S. Food and Drug Administration has specifically approved for treating MRSA infections.

MRSA and MSSA each were detected in 83% of untreated influent samples. But the percentage of MRSA- and MSSA-positive samples decreased as water treatment progressed, making up only 8% and 17% of samples of fully treated effluent, respectively. There was some evidence that MRSA isolates that survived initial stages of treatment may have been resistant to more antibiotics and may have had a greater prevalence of a gene associated with virulence than other isolates in influent samples. However, chlorination, the tertiary stage in wastewater treatment, appeared to eliminate all MRSA. Only one WWTP had the bacteria in a subset of final effluent samples, and this occurred only when tertiary chlorination was not carried out.

The researchers genetically profiled only a subset of the MRSA isolates, so they may have underestimated the diversity present in the WWTPs. They also did not determine the levels of MRSA and MSSA in the samples. Nevertheless, the study suggests that WWTP workers and people who live, work, or play near the increasing number of agricultural and recreational sites irrigated with reclaimed wastewater could be exposed to MRSA and MSSA. Risk might be

Scanning electron micrograph of MRSA (yellow) surrounded by cellular debris (orange)



reduced through frequent hand washing and the use of gloves among WWTP workers and through tertiary treatment of wastewater that is to be used for irrigation.

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## Here Today, Here Tomorrow?

### Urinary Concentrations of Parabens over Time

Parabens are antimicrobial preservatives added to foods, pharmaceuticals, and personal care products. These compounds have been detected in 92% of a representative sample of the U.S. population. The two most commonly used forms—methyl paraben (MP) and propyl paraben (PP)—are classified as “generally recognized as safe” by the U.S. Food and Drug Administration, although there is some animal and human evidence these chemicals may be endocrine disruptors. The ubiquity of paraben exposure and the potential for adverse health effects prompted investigators to study how exposure varies over time in men and women [EHP 120(11):1538–1543; Smith et al.].

Between August 2005 and November 2010 the research team collected an average of 4 spot urine samples each from 245 male and 408 female patients at the Fertility Center at Massachusetts General Hospital in Boston. Samples were collected upon recruitment for the study, at followup visits during infertility treatments, and during pregnancy, and were analyzed for concentrations of MP, PP, and the less widely used butyl paraben (BP).

MP and PP, which are often used in combination, were detected in more than 95% of samples, with a high correlation between the two suggesting a common source of exposure. MP and PP concentrations were more than 4 times higher in women than in men and more than

3 times higher in African Americans than in Caucasians. BP was detected in more than twice as many women (74%) as men (36%), and concentrations were more than 4 times higher in women than in men but less variable between Caucasians and African Americans. These results could reflect differences between men and women and between African Americans and Caucasians in the use of products containing parabens. They also could reflect pharmacokinetic differences.

Women showed more temporal variation of urinary paraben concentrations than men, possibly reflecting changes in their use of personal care products over time. Those women who became pregnant during the study period generally had lower urinary paraben concentrations during pregnancy than before, with evidence suggesting that concentrations decreased with each additional week of pregnancy. This, too, could reflect changes in foods eaten or products or medications used during pregnancy.

Nevertheless, the relative stability of individuals’ urinary paraben concentrations over time suggests that a single urine sample could provide a reasonably representative snapshot of an individual’s exposure to parabens over the course of several months. Likewise, a single urine sample collected during pregnancy could reasonably predict exposure throughout pregnancy. However, results were based on a population that was mostly Caucasian and well educated, and their generalizability to other demographic groups is uncertain.

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